two of these veins are seen to unite. The other veins are short and apparently contain little workable ore.

In some of the mines, particularly the Wickert, the vein was offset by a few small faults, but the continuity and parallelism of the major veins indicates little displacement.

The ore continues to the lowest depths reached by mining; in fact, in several mines the ore improved in quality and the veins widened in the lowest levels, and there is little doubt that the ore bodies extend as deep as profitable mining can ever be done.

Character and composition.—The magnetite ores in the region are usually known as the “hard ores” or “rock ores” to distinguish them from the brown (limonite) iron ores. Except near the surface, where weathering has removed the accompanying pyrite and decomposed the feldspar, the ore is compact and hard but so brittle that it breaks readily. Specimens of many different kinds of ore can be obtained, even in a single mine.

The most abundant variety of ore shows somewhat indistinct laminations which differ in the quantity of gangue minerals present. These layers are from a quarter to half an inch in thickness. In some mines considerable ore consists of alternating layers of quartz and magnetite that suggest crustification, such as occurs in veins formed in open fissures. The bands of pure quartz are as much as three-quarters of an inch thick in some places.

The magnetite occurs in some ores as irregular masses, but in most ores it forms in lenses or layers, especially in those ores that consist mainly of quartz and magnetite. Some of the magnetite grains inter-locking with the gangue minerals or included within the quartz are clearly older than other particles which form small veinlets that cut across the gangue minerals.

Quartz is by far the most abundant gangue mineral, and much of the ore consists almost exclusively of magnetite and quartz. The quartz is mostly clear and has a slight bluish tint. It occurs as single irregular grains or as lenticular or veinlike bands with a fine granular texture. Many small grains of magnetite are included in the quartz, and in places the quartz is cut by thin bands of pure magnetite.

Feldspars, mainly white or light-green plagioclase but also some orthoclase, are common constituents of the gangue and occur as irregular grains or as slightly elongated lenses or “augen.” Pyrite is abundant in places and shows a tendency to form rims about grains of quartz or to occur as thin streaks along joint planes, although irregular grains of it are disseminated throughout much of the ore. Hornblende is an abundant constituent in certain places but is practically absent in most of the ore. Much of the hornblende has altered to chlorite. Coarse hornblende is common in the wall rock. Biotite occurs like hornblende but is somewhat more abundant. Bands in which biotite is the most abundant constituent are common in highly laminated ores, especially in contact with the streaks of fairly pure quartz. Ilmenite can seldom be detected, but some of the analyses show a rather high percentage of titanium.

Analyses of the magnetite ores of the region show approximately the following ranges and averages: